MOBILITY OF PRIMARY FACTORS AND ITS EFFECTS ON ECONOMIC GROWTH AND WELFARE GENERATED BY RURAL CREDIT IN BRAZILIAN REGIONS

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ABSTRACT

This paper investigates the effects of primary production factor mobility on economic growth and welfare generated by the interest rate equalization policy (ETJ) in the agricultural sector in the Brazilian regions. This study uses the General Equilibrium Analysis Project for the Brazilian Economy (PAEG) to perform the analytical simulations. The study analyzes a scenario in which the value of the ETJ policy and the subsidized rural credit provided by the ETJ are eliminated from agriculture. The subsidized credit is reallocated among the various sectors in the economy. The scenario is analyzed considering the mobility of three different primary production factors among Brazilian regions: zero mobility, partial mobility and complete mobility. The results are presented with the signals exchanged to obtain the effects of ETJ policy on the economy. The results suggest that GDP growth is lower than the subsidy cost in all Brazilian regions except in the Midwestern and Southearn regions with complete factor mobility. In terms of generating economic growth, the ETJ policy therefore presents a negative rate of return. When one considers the analysis in terms of welfare, the shock effects are positive and higher than the cost of the policy to all regions of Brazil. In terms of welfare generation, the ETJ policy therefore presents a positive rate of return.

Keywords: rural credit, primary factors mobility, general equilibrium, PAEG

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1. Introduction

Interventionist policies in agricultural markets are common in developed and in underdeveloped countries. However, these policies are criticized by certain multilateral institutions, such as the World Bank, the International Monetary Fund (IMF) and the Organization for Economic Co-operation and Development (OECD). In partial equilibrium models classical theory postulates that agricultural subsidies lead to allocative and distributive inefficiency and to social cost. Most developed countries, however, adopt an interventionist policy that insists on the practice of subsidies. These governments reason that the absence of protection would cause many farmers to abandon their activities, thereby aggravating social problems. From the foregoing it is questionable whether social reasons motivate the practice of subsidies or whether this policy promotes greater economic growth than its cost.

The social reasoning includes maintaining employment in the field, and the purchasing power of the rural population, among other arguments, is used as a foundation for the adoption of agricultural policies. Also, the maintenance of subsidies can happen for economic reasons. Gasques and Villa Verde (2003), Castro and Teixeira (2004), and Cardoso, et.al (2011) consider the existence of positive effects on economic growth in Brazil in addition to the social benefits.

A study by Taylor (1994) argues that agricultural incentives combined with increased income can generate an economic development process as it also positively impacts non-agricultural sectors.

A study by Cardoso et.al (2014), which uses 2004 data to apply a general equilibrium model, PAEG, simulated the elimination of agricultural credit subsidies received through the interest rate equalization policy, ETJ. They found a positive rate of return for the subsidy in generating economic growth and welfare. Thus, the authors

establish the importance of the ETJ policy in promoting economic growth and welfare in the Brazilian regions.

According to Mundell (1961), the general equilibrium of an economy is affected by the mobility of production factors. The neoclassical production theory postulates that there is migration of labor from low-wage regions to regions with higher wages until the differences are eliminated. In a perfect market, capital will flow from a low rate of return regions to higher-yielding regions, until again, the differences cancel out.

According to Souza (1981), the mobility of factors is not complete, but dynamic, and a number of restrictions occur that influence this process. Despite the migration of labor, work opportunity, travel expenses, distance and cost of settlement are some of the limiting factors to the migrant. In relation to capital mobility restrictions, the author considers the instability of regional demands, capital immobility due to physical investments such as equipment or infrastructure in a given location, beyond the security factors that hinder the access of small firms to capital. In addition, according to Souza (1981), the elements are not evenly distributed in the territory; there is heterogeneity and discontinuity, as well as a lack of transport routes in all directions, population and industrial concentration.

This paper is divided into three sections in addition to this introduction. The second section is the methodology with the presentation of the PAEG model, the source of data and analytical scenario. The third section presents the results. The fourth section presents the primary conclusions.

2. Methodology

Applied General Equilibrium models follow a Walrasian theoretical basis where the economy is competitive and has two main actors, producers and consumers. The agents produce, consume and sell services and products. Consumers, with their budget

constraints and preferences baskets, demand goods maximizing their utility function. Preferences are hypothetically continuous and convex, and their resulting continuous demand functions are zero degree homogeneous with regard to prices, i.e., only relative prices can be determined.

On the production side, technology is described by a production function with constant returns to scale, meaning that, in equilibrium, the profit of firms is null. Firms are assumed to have a specific technology of production and demand factors to minimize their costs. These models enable analysis of direct and indirect effects arising from changes in public policies such as tariff shocks, tax rates and endowments (TEIXEIRA, PEREIRA, GURGEL, 2013, p.14).

To capture the allocative and distributive effects that an interventionist policy can generate within agricultural markets, the analysis applied a Computable General Equilibrium model that is the most suitable, as these models allow the goods market to be captured along with the factors and sectoral distribution of income. The theoretical framework that supports the research in question therefore builds on the classical analysis of general equilibrium of the economy.

2.1. PAEG Model

PAEG (Teixeira, Gurgel and Pereira, 2013) is a static, multi-regional and multi-sector model and was elaborated based on GTAPinGAMS (Rutherford and Paltsev, 2000; Rutherford, 2005) which, in turn, stems from the GTAP (Hertel, 1997; GTAP, 2001). There are some differences between the two models. Unlike the GTAP, which uses GEMPACK language (Codsi and Pearson, 1988), the PAEG adopts the basic structure of the GTAPinGAMS model, which was designed as a nonlinear mixed complementarity problem in GAMS programming language (General Algebraic Modeling System (Brooke et al., 1998). Additionally, according to Teixeira, Gurgel and

Pereira (2013), in PAEG the database for the Brazilian economy was disaggregated to represent its five major regions (Midwest, North, Northeast, South and Southeast), keeping intact the GTAP aggregation for the other regions of the world and the data of trade flows between Brazil and other regions of the world.

The PAEG model represents the way goods and services are produced in the Brazilian and world economies. The regions are represented by a final demand structure and the behavior of agents is that of an optimizer in that they maximize their well-being subject to its budget constraint considering fixed investment and production in the public sector. The productive sectors minimize costs with a combination of intermediate inputs and primary factors given technology. Bilateral trade flows between regions, transport costs, taxes and/or subsidies are also present in the database (GURGEL et.al, 2011). Table 1 describes the indices represented in the model.

Table 1:   Database indices used in the PAEG, 2007.

Index	Description
i, j	Sectors and goods
r, s	Countries and regions
f ∈ m	Mobility`s Free Production Factors among a determined region: labor; capital
f ∈ s	Fixed Production Factors: Natural resources

Source: Gurgel *et al.* (2011).

The function of this model can be shown from the macroeconomic accounting identities. Domestic production is distributed among exports, international transportation, intermediate demand, private consumption, investment and government consumption. Imported goods are used in intermediate consumption, private consumption and government consumption.

In the production of good j (Y_{ir}) includes intermediate inputs (domestic and imported), mobile factors of production and consumption of public sector. The income of the factors of production is distributed to the representative agent. The equilibrium in

factor markets is given by an identity that relates the amount of the payment of the factors with the income thereof.

Equilibrium in trade requires that exports are equal to imports. Similarly, aggregate supply of the transport service is equal to the value of transport service exports. Equilibrium between supply and demand in the transport services market equals the sum of the bilateral flows of transport services.

The government's income is given by the sum of taxes and transfers. The government budget constraint can therefore be represented by equation (1).

$$vgm_r = \sum_i R_{ir}^Y + R_r^C + R_r^G + \sum_i R_{ir}^M + R_r^{HH} + vb_r \tag{1}$$

where (R_{ir}^Y), (R_r^C), (R_r^G) (R_{ir}^M) are indirect taxes on production and export on consumption, government demand and imports, respectively. R_r^{HH} is the indirect taxes to the representative agent, as well as transfers from abroad, vb_r.

The budget constraint of the representative agent relates the income of the factors of production, minus the tax payments, with consumer spending and private investment.

Therefore, based on the presented identity, two types of condition can be viewed: market equilibrium (supply equal to demand for all goods and factors of production) and the balance of income (net income equal to the net expense). In the PAEG model perfect competition and constant returns to scale are assumed, so that production costs are equal to the value of production, and economic profits are zero. This condition applies to each of the productive sectors and activities.

The model of economic identities, however, does not describe the behavior of economic agents. To understand the functioning of the model, it is necessary to describe how agents and sectors behave. However, not all behavioral functions will be presented.

The firm behavior is defined by the optimizer and production functions, and manufacturing is depicted in block because it utilizes the syntax MPSGE algorithm developed by Rutherford (1999). The productive sectors combine intermediate inputs and primary factors to minimize costs, given the technology. Figure 1 shows the "technological tree" representing the Y_{ir} supply block and describes the technologies undertaken by firms in the model industries.
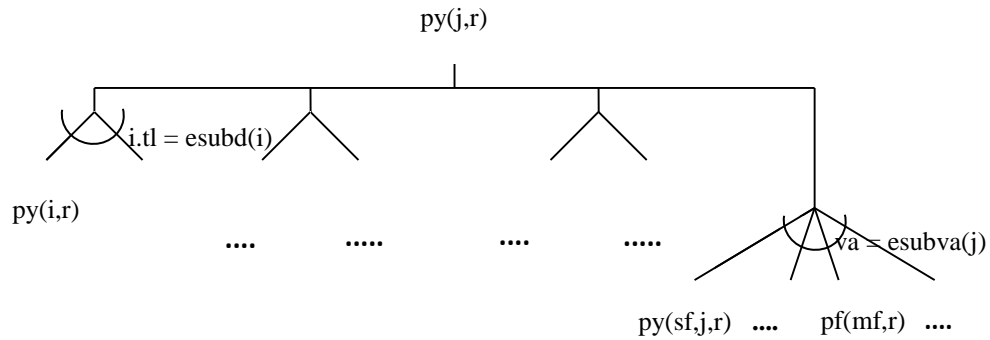
esubva(j): elasticity of substitution between production factors that are part of the value added.
esubd(i): elasticity of substitution between domestic and imported factors.
Source: Adapted Gurgel et al. (2013).

Figure 1: Technological Tree of the Productive Structure of PAEG.

As shown in Figure 1, the supply of firms is defined by an optimization problem and the goal is to minimize unit costs, from the combination of primary production inputs and intermediate inputs, domestic and imported. So, first, firms decide the combination of primary factors that will be used $(py(sf,j,r))$ and $(pf(mf,r))$. The decision is based on the elasticity of substitution between factors of production that make up the value added $(esubva(j))$. Later, they acquire intermediate input baskets on which they decide between domestic and imported goods $(py(i,r))$ by elasticity of substitution $(esubd(i))$. The final product is represented by $(py(j,r))$.

Figure 2 shows the output block (ftr) responsible for allocating factors among different regions in response to changes in the economy. In this block, the appropriations of a type of factor (f) arising from all regions are available as inputs, to

be made into regional factors that will be used specifically in each region. The symbol σ determines the elasticity of transformation of a factor of a region with respect to that same factor from another region.
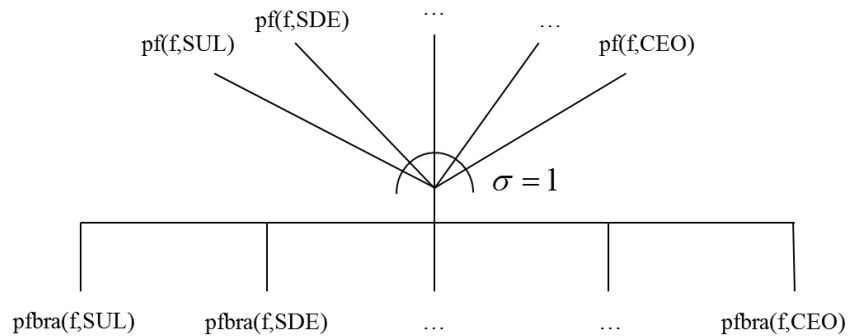
σ = Elasticity of the transformation among the factors of different regions.
pfbra: Endowment`s price factor in each region.
pf: Endowment`s price of national factor.
Source: Adapted from Gurgel et al. (2013).

Figure 2: Technological Tree of the allocation block factors of PAEG.

The primary factors have elasticity of substitution equal to zero, i.e., Leontief function in the initial equilibrium. That elasticity defines the factors of the different regions as always being combined in fixed proportions according to the initial regional allocation. In another situation, after a shock, these factors are distributed to the various regions considering a Cobb-Douglas function of transformation between regions, elasticity of transformation, $\sigma = 1$, that is, there cannot be free movement of capital or labor from one region to another given differences in the compensation of factors because the characteristics and composition of the factors of each region are not exactly alike. However, this block allows some degree of factor mobility to be represented between regions to the extent that a change in the relative income of a region compared to the other tends to attract labor and capital from other regions of the country. The elasticity of transformation can also be changed to represent the possibility of free mobility of factors among Brazilian regions ($\sigma = \infty$) such that after a shock any difference in return between regions of a factor is completely eliminated by migration

factors, which means that there is only one price (salary or return of capital) in all regions of the country. This means that after a shock the total of capital and labor used in a given region need not be equal to the initial allocation of these factors, maintaining, however, the aggregate consistency at the national level, that the sum of the factor used in the five Brazilian regions is equal to the sum of the initial allocation factor in the regions.

The optimization problem in the production of Y_{ir} defines a production function with a constant elasticity of substitution (CES), where the value added components (primary factors) can be replaced with this particular process from a substitution represented elasticity by parameter $esubva_j$ in the model. The intermediate inputs and value added are combined from a Leontief function, and they cannot be substituted for each other. Each intermediate input j in that Leontief function is a combination between a domestic and imported portion of the same good j, from a CES function, represented by parameter $esubd_i$.

Public sector consumption is represented in the model by a Leontief aggregation, consisting of domestic and imported goods. Private agent consumption can be represented as a cost minimization problem.

In the PAEG model, measurement of results is given by parameters and calculations of the impact of the implemented scenario. Equivalent Variation (EV) is the name given to the parameter that stores the result of the percentage change in welfare.

The closure of the PAEG model considers fixed total supply of each factor of production but ensures mobility across sectors within a region. The mobility of the primary factors among Brazilian regions can be total, partial or non-existent, and this study will make an analysis for the three situations. The model considers that there is no unemployment; therefore, factor prices are flexible. On the demand side, investment and

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capital flows are kept fixed, as is the balance of payments. Thus, changes in the real exchange rate must occur to accommodate changes in the flows of exports and imports after shocks. Government consumption can change with changes in the prices of goods, as well as the net revenue from taxes that are subject to changes in activity levels and consumption. Table 2 shows how the sectors and regions of the model were included in this study.

Table 2: Sector and Region Aggregation in PAEG.

Sectors	Acronym	Regions	Acronym
Rice	(pdr)	Brazil – North	NOR
Corn and cereals	(gro)	Brazil – Northeast	NDE
Soy and other oils	(osd)	Brazil – Middle West	COE
Sugar cane, sugarbeet and sugar industry	(c_b)	Brasil – Shoutheast	SDE
Meat and livestock	(oap)	Brazil – South	SUL
Milk and dary products	(rmk)	Rest of Mercosur	RMS
Agribusiness products	(agr)	Venezuela	VEM
Foods	(foo)	United States	USA
Textile Industry	(tex)	Rest of Nafta	RNF
Clothes and shoes	(wap)	Rest of America	ROA
Wood and furniture	(lum)	Europe	EUR
Cellulose and grafic industry	(ppp)	China	CHN
Chemical, plastic and rubber industry	(crp)	Rest of the world	ROW
Manufactured	(man)		
Gas, electricity, and distribution of water	(siu)		
Building	(cns)		
Sales	(trd)		
Transport	(otp)		
Service and Public service	(adm)		

Source: Research results.

2.2. Analytical Scenario

The structured analytical scenario assumes zero mobility, partial and full mobility of production factors (labor and capital) among Brazilian regions. The change in the mobility factor is obtained by modifying the elasticity of transformation, σ, in the production block *ftr*. When considering $\sigma = 0$, a Leontief transformation function is assumed, which represents the absence of mobility between production factors, i.e., they are combined in fixed proportion before and after the impact of the shock. When $\sigma = 1$,

it is considered a Cobb-Douglas transformation function, which is the combination of factors that make up partial mobility. In the latter case the σ parameter is left free (σ = ∞), representing full mobility of factors.

To measure the effect of the ETJ policy on all Brazilian regions, all government spending with the ETJ policy are eliminated, together with all subsidized rural credit provided by the ETJ policy. A proportion of total subsidies for each crop and region is calculated from government spending with the ETJ for each agricultural product in each macro-region. A shock is promoted in the variable (rto) only in the agricultural sector activities. This first part of the shock simulates the complete elimination of ETJ. In some activities in some areas, the rates found for ETJ are greater than the rate of the total agricultural subsidy represented in PAEG, so when the rate of ETJ exceeds the total agricultural subsidy in PAEG, it is considered an ETJ subsidy and therefore all of it is removed. However, when the ETJ rate does not exceed the overall subsidy rate in certain activity in PAEG, only the portion of the ETJ of the total subsidy is removed.

After the implementation of shock extracting the ETJ subsidy from the agricultural sector, the credit provided by the ETJ subsidy is excluded and it is allowed to be freely reallocated across sectors (including agricultural), according to the attractiveness of the sectors .

To remove the agricultural credit supplied by the ETJ a device modeling is created. This device consists of adding a new fixed production factor (artificial) to receptor sectors of ETJ at the rate of only 1% of the total production value of each credit receptor sector subsidized by ETJ, not to distort the sector accountability. This new fixed production factor should be considered a perfect complement (Leontief) to the aggregate of other inputs and factors of production used by the industry. The credit

withdrawal shock therefore decreases the supply of the artificial factor of production in the same proportion as the sector gets the credit of ETJ. For example, if the credit available from ETJ for any sector in the southeast region is calculated as 10% of the sector's output in the base year of the model, the shock decreases the supply of artificial fixed production factor in that sector by the same 10%. As such a factor has a perfect complementary relationship with the other inputs and factors used by the sector, the industry will be ensured to reduce the total volume of resources used for its production by 10%. These resources can then be used in any other sector of the economy. To ensure that even the agricultural sectors will be a recipient of this volume of credit if they are competitive enough, the artificial fixed factor is allowed to be produced from a function that combines capital and labor. The proportions of capital and labor in this sector are the same of these factors in the total stock of factors in the region. Thus, if a particular agricultural sector is still relatively more competitive and attractive than others, even without the ETJ subsidy, subsidy removal and the forced withdrawal of credit associated with the subsidy to that sector will not prevent the sector from growing again.

3. RESULTS

This section shows an analysis of the simulation results for the scenario proposed in this research.

3.1 Effects of government spending and rural credit provided by ETJ with relocation of this credit in regional economies

The objective is to implement a shock that exclude the ETJ subsidy and credit available via ETJ from the agricultural sector. This credit will be reallocated to the other sectors (including agriculture) according to their attractiveness. All results are presented and discussed with opposite signs, representing the effect the introduction of the subsidy and rural credit via ETJ would have on the agricultural sectors. These results represent

the return of the subsidy and rural credit in their best alternative employment. The analysis is made considering zero, partial and total mobility of primary production factors among Brazilian regions.

3.1.1 Impacts on GDP and return to primary factors

It is examined the effects of the subsidy and the rural credit provided by ETJ in terms of its ability to promote economic growth and welfare in the Brazilian regions. Table 3 shows the results for variations in GDP of the Brazilian regions, in monetary terms, compared to government spending with the ETJ policy.

It appears that when there is no primary factor mobility among regions the ETJ generates an increase in GDP in the Brazilian regions, with the exception of the Southeast. The Northeast was the largest beneficiary of the policy. The ETJ subsidy in this region, US$ 0.19 billion, provided US$ 0.85 billion in rural credit. The ETJ, and subsidized credit, generated an increase in GDP by US$ 0.07 billion. The multiplier effect in the region shows that for every dollar spent on ETJ policy, there is an increase of US$ 0.40 in GDP.

With partial mobility, the results show that the action for ETJ policy and subsidized credit generate an increase in GDP in three of the five regions analyzed. The Southeast region was the one with the most positive outcome, in terms of GDP increase, US$ 0.27 billion. In term of the multiplier, for every dollar spent on ETJ, there is an increase in GDP by US$ 0.49.

The total mobility of production factors between regions generates different effects on GDP. When ETJ subsidy and credit are present, only the Midwestern and Southern regions respond positively. While for the North, Northeast and Southeast the effect on GDP is negative.

Table 3: Effects of the interest rate equalization policy, ETJ, and rural credit, on Brazilian regions GDP, 2007 (US$ billion).

Regions	ETJ[1]	Credit	Null Mobility		Partial Mobility		Total Mobility	
			Effects on GDP[2]	Multiplier 2/1	Effects on GDP[3]	Multiplier 3/1	Effects on GDP[4]	Multiplier 4/1
NORTH	0.06	0.28	0.01	0.18	-0.15	-2.45	-0.39	-6.41
NORTHEAST	0.19	0.85	0.07	0.40	-0.14	-0.78	-0.17	-0.92
MIDWEAST	0.24	1.17	0.05	0.20	0.01	0.03	0.28	1.21
SOUTHEAST	0.55	2.70	-0.05	-0.08	0.27	0.49	-0.33	-0.61
SOUTH	0.60	2.90	0.06	0.10	0.20	0.34	0.83	1.37
BRAZIL	1.63	7.92	0.15	0.09	0.19	0.11	0.21	0.13

In the absence of factor mobility, ETJ subsidy and credit generally causes growth in GDP less than the cost of the policy, i.e., an increase of US$ 0.15 billion in the Brazilian GDP compared to an ETJ subsidy of US$ 1.63 billion. The presence of ETJ policy, in terms of generating economic growth, presents a negative rate of return, i.e., for every dollar spent on ETJ in Brazil, there is an increase of US$ 0.09 in the economy.

When there is partial mobility of production factors, the aggregate result, for Brazil, shows that the policy generates economic growth in terms of GDP, US$ 0.19 billion, with a negative rate of return, i.e., for every dollar spent on ETJ policy, there is an increase of US$ 0.11 in the Brazilian GDP.

Considering the full mobility of factors of production, the same result is observed. That is, the subsidy rate of return is negative in terms of generating economic growth. Each subsidy dollar spent generates a GDP increase of US$ 0.13.

Under total primary factor mobility, the Midwestern and South regions present positive rates of return to the ETJ policy of US$ 1.21 and US$ 1.37, respectively.

We conclude that the stimulus generated by the ETJ subsidy in terms of competitiveness of the agricultural sectors in the South and Midwest should make these much more attractive regions for agricultural production.

The Southeast region showed economic growth that is negative with the ETJ policy under null and full mobility of production factors.

The results contradict the initial hypothesis of this research and can be explained by the standard relative competitiveness of different Brazilian regions through the different analyses, mobility of capital and labor adopted.

Considering the different effects on the mobility of production factors analyzed in this study, Figures 3 and 4 show the percentage change in the return to capital and salary, due to the subsidy and credit shock.

Figure 3 shows that spending on ETJ and subsidized credit generates increases in the return to capital and paid wages, relative to the benchmark. The greatest results are for the South and Midwest, followed by the Southeast. As there is no regional mobility between the factors of production, regions that receive larger subsidies to the agricultural sector, and a larger subsidized credit, will realize greater effects.
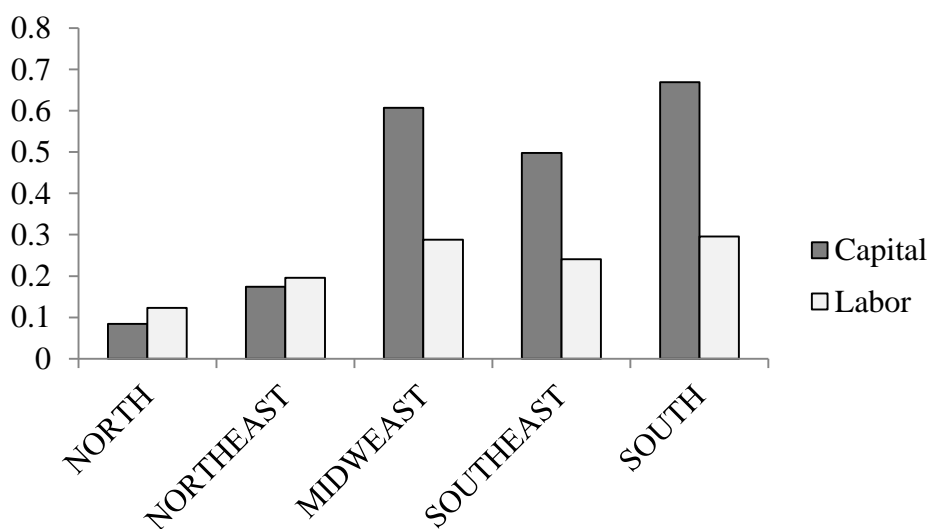

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Figure 3: Effect of ETJ and subsidized credit on the return to capital and labor in Brazilian regions considering lack of mobility of production factors, 2007 (%).

It is considered that the situation of no factor mobility is a limitation that may underestimate the results because the relocation of the volume of credit circulating in

the economy before the subsidy cannot be absorbed efficiently by the sectors in the Brazilian regions.

From Figure 4, the ETJ policy and subsidized credit to the agricultural sector, in a scenario where the productive factors circulate freely among Brazilian regions, caused growth in the return to capital and paid salary, relative to the benchmark.

These changes in the remuneration of factors come from the forces of demand by factors, given the economic sectors demanding more productive factors, and supply factors, given by the initial allocation and the possibility of mobility between regions. A greater appreciation of the factors in real terms suggests further warming of economic activities in the region and possibly greater attraction of resources.
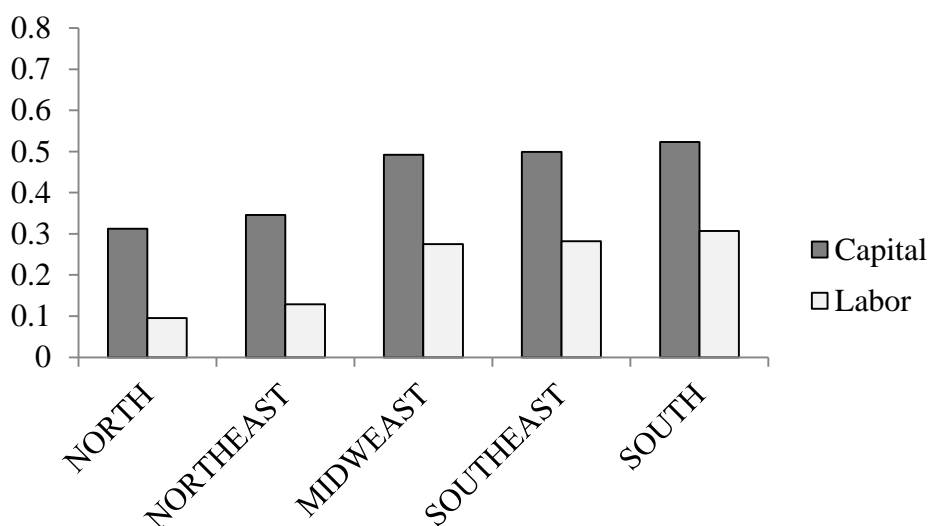

Figure 4: Effect of the ETJ and subsidized credit on the return of capital and labor in the Brazilian regions, with full mobility of production factors, 2007 (%).

The total mobility of factors of production among Brazilian regions attenuates the return of the expansion effects to capital and earnings, which are more pronounced when there is lack of mobility because after the shock, capital and labor will migrate to regions where there are better returns. With increased supply factors, to fulfill the demand of the sectors in each region, there will be a decrease in the factors return until it reaches the equilibrium.

The Return to Capital analysis with partial mobility of factors is presented in Table 4, which shows the changes in percentage terms in the Consumer Price Index (CPI), the employee capital supply and return to paid capital in the Brazilian regions. The result shows that the return on capital is increasing. Return of capital has grown more or decreased less than the CPI. Looking at the last column, it is observed that under partial mobility of primary factors, the return to capital perceived by the representative agent is greater than the change in the CPI.

Table 4: Effects of the ETJ policy on the CPI, the supply and return to capital in the Brazilian regions considering partial factor mobility, 2007 (%).

Region	CPI	Capital supply	Firm payment to capital[*]	Real return to local capital[**]
NORTH	0.124	-0.305	0.161	0.003
NORTHEAST	0.156	-0.193	0.236	0.099
MIDWEAST	0.116	0.051	0.512	0.055
SOUTHEAST	0.134	0.053	0.511	0.790
SOUTH	0.133	0.133	0.581	0.297

[*]Refers to the price (or compensation) of factor that is paid by the sectors that use the factor. The equilibrium price is given by the factor's supply forces, including the total factor available in the region, plus the portion that migrated to this region, and the forces of the factor demand.

** Refers to the price the factor received by the original families in the region. This price is the result of the balance between the total factor originally offered by the region (factor's initial stock) and the demand originated in the factors transformation function.

In the Northern and Northeastern regions there is a decrease in the supply of capital, showing that those regions are less attractive to capital. To fulfill the demand of the sectors by this factor this decrease in the supply of capital generates an increase in factor remuneration. This increase in the return to capital was higher than the increase in the CPI, such that families holding capital that were already in these regions, will perceive a small increase in the real return on capital.

In the Midwest, Southeast and South regions there is an increase in the supply of capital. Despite the increase in factor supply in these regions, there is a positive change in their remuneration. This is an indication that the Midwest, South and Southeast, which are the regions that receive a higher volume of subsidized credit, are more

sensitive to the ETJ shock. Family holders of capital that were already in these regions perceive positive changes in equity compensation.

Table 5 shows the changes in percentage terms of the CPI, the labor supply and return of the salary paid in the Brazilian regions.

There has been a decrease in labor supply in the North, Northeast and Midwest. To fulfill the demand of the sectors by this factor, this fall causes an increase in the salary paid by the productive sectors in these regions. Local families, in turn, experience a small decrease in labor income.

Table 5: Effects of the ETJ policy on the CPI, labor supply, wages paid by firm, and local labor return in the Brazilian regions considering partial factors mobility, 2007 (%).

Region	CPI	Labor supply	Firm payment to labor*	Real return to local labor**
NORTH	0.124	-0.174	0.088	-0.086
NORTHEAST	0.156	-0.068	0.156	-0.032
MIDWEAST	0.116	-0.014	0.243	-0.032
SOUTHEAST	0.134	0.032	0.287	0.455
SOUTH	0.133	0.048	0.293	0.118

* Refers to the price (or compensation) of factor that is paid by the sectors that use the factor. The equilibrium price is given by the factor's supply forces, including the total factor available in the region, plus the portion that migrated to this region, and the forces of the factor demand.
** Refers to the price the factor received by the original families in the region. This price is the result of the balance between the total factor originally offered by the region (factor's initial stock) and the demand originated in the factors transformation function.

Local unskilled labor realizes a devaluation in its purchasing power. The result for the Midwestern region reflects that the characteristic of the agricultural sector in the region has more intensive use of capital factor.

Southeastern and Southern expanded their labor supply. These regions are more sensitive to the ETJ policy shock, and increase salary paid. Local families experience an increase in labor income, thus the local labor realizes an appreciation of its purchasing power.

When considering factors partial mobility, capital and labor move between regions, but in a limited way, different from a situation where there is full mobility of factors. Total mobility between regions allows factors to move to equalize their respective compensation between regions. Therefore, in areas where the factor would become more scarce, and therefore more in demand, there is greater attraction of this factor coming from other regions until the increase in supply in the most attractive region and the reduction in less attractive regions, allow equilibrium in their remuneration at the same level for all regions. For partial mobility, there are economic and institutional constraints that prevent the full equalization of remuneration of these factors between regions. Therefore, the remuneration received by the same factor differs between regions, which means that the factor that remained in a given region may receive a different remuneration.

Effects of ETJ subsidy on Brazilian regions' welfare

The subsidy policy has a direct impact on consumption agents' welfare[2], as it influences the amount of services produced, the export and import flow, income and output prices in the economy. Table 6 shows how primary factor mobility affects welfare in each Brazilian region.

Table 6: Effects of ETJ subsidy and rural credit on the Brazilian regions welfare measured by equivalent variation (EV), 2007 (US$ billion).

Regions	ETJ[1] subsidy	Credit	Null Mobility		Partial Mobility		Total Mobility	
			EV US$ billion[2]	Mutiplier 2/1	EV US$ billion[3]	Mutiplier 3/1	EV US$ billion[4]	Mutiplier 4/1
NORTH	0.06	0.28	0.05	0.83	-0.01	-0.19	0.12	1.95
NORTHEAST	0.19	0.85	0.21	1.16	0.06	0.30	0.30	1.61
MIDWEST	0.24	1.17	0.38	1.61	0.02	0.07	0.32	1.34
SOUTHEAST	0.55	2.70	1.77	3.22	2.96	5.39	1.86	3.38
SOUTH	0.60	2.90	1.05	1.74	0.46	0.76	0.90	1.49
BRAZIL	1.63	7.92	3.46	2.11	3.47	2.13	3.50	2.14

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[2] There is a change in the welfare level of the agents when there are changes in their consumption of goods and services.

The results show that there is a welfare increase in the presence of te ETJ policy due to the fall in the prices of agricultural products and thereby an increase in consumption.

All regions show welfare increase with the exception of the North region with partial mobility. For Brazil, the analysis presents positive variations in welfare. In the absence of factor mobility, equivalent variation was US$ 3.46 billion, with partial mobility, US$ 3.47 billion and with full mobility, US$ 3.50 billion.

The subsidy return in terms of generating welfare is positive in brasilian regions, with the exception Northearn region, and in the aggregate Brazil. This effect is negative only for the North when considering the partial mobility of production factors.

The results show that when considering no factor mobility, except for the North region, all other regions have a multiplier effect that generates positive returns, that is, for every dollar spent on the policy, there is a return greater than US$ 1.00 on welfare.

Welfare is determined by household consumption, so foods are an important component of the consumer basket, especially in the North, Northeast and Midwest. Thus, despite the subsidy economic distortion, a flow of subsidized resources to the agricultural sector is allowed, which generates an increase in the supply of agricultural goods that reduces prices in the food sector, resulting in gains for consumption and family welfare.

3. CONCLUSIONS

The objective of this paper was to contribute to the discussion related to state intervention in the economy, analyzing how the mobility of the primary factors, capital and labor affect economic growth and welfare generated by the interest rate equalization policy (ETJ) in Brazil.

The study was developed using the methodology set named General Equilibrium Analysis Project for the Brazilian Economy (PAEG). The simulated scenario eliminates the ETJ credit subsidy and all the rural credit generated by the policy from the agriculture sector. Subsequently this subsidized credit is reallocated to all sectors in the economy (including agriculture) according to their attractiveness. The analysis is performed considering three situations of primary factor mobility: zero, partial and total mobility.

When analyzing the mobility of production factors, it is concluded that in terms of GDP growth, the Southern region and the country of Brazil as a whole respond positively to increased mobility. In other words, the higher the factor mobility, the higher the GDP growth. The opposite happens with the Northern and Northeastern regions, i.e., the higher the mobility of factors, the greater the negative changes on GDP. The Midwestern region responds more positively when there is total factor mobility and the Southeastern region when there is partial factor mobility.

The ETJ policy promotes positive GDP growth for most regions, and for Brazil as a whole, but presents a negative rate of return in terms of generating economic growth. All regions respond positively to the ETJ policy in terms of welfare with the exception of the Northern region. As in the GDP analysis, the welfare variation in those regions does not have a regular pattern according to the mobility of factors. The ETJ policy generates increased wellbeing greater than its cost to Brazil.

It is concluded that some government policies may prove effective in terms of generating growth of GDP and welfare. The research, therefore, complied with the objective of analyzing the effect of factor mobility on economic growth and welfare generated by the interest rate equalization policy in the Brazilian regions.

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